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1976

**AGRICULTURAL RESEARCH**

**KEY TO  
A BETTER  
FUTURE**

**ANNUAL REPORT, 1976**  
AGRICULTURAL EXPERIMENT STATION  
UNIVERSITY OF MARYLAND

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# INTRODUCTION



On October 18, 1976, W. Lamar Harris became the eighth director of the Maryland Agricultural Experiment Station.

Dr. Harris brings a wealth of excellent training and experience to the job. A native of Taylorsville, Georgia, he received B.S. and M.S. degrees in agricultural engineering from the University of Georgia at Athens. He received his Ph.D. from Michigan State University in 1960, and joined the faculty of the University of Maryland that same year.

He has been professor of agricultural engineering in the Division of Agricultural and Life Sciences, where, prior to his appointment to the directorship, he served as chairman of the Department of Agricultural Engineering.

Dr. Harris belongs to several professional organizations and has had an active part in formulating programs on the national level in areas of agricultural concern.

Maryland Agricultural Experiment Station

Annual report

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A33.001

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# ANIMAL AND AVIAN AGRICULTURE





Cows can eat forage treated with the chemical preservative ammonium isobutyrate without fear of any effects on milk quality, according to research just completed by dairy scientists.

## Testing Milk Quality

Maryland dairymen can feed their cows hay treated with the chemical preservative ammonium isobutyrate, without fear of an adverse effect on the milk. Feeding tests by dairy researchers at the University of Maryland have revealed no significant difference in either the amount or quality of milk when ammonium isobutyrate was applied to high moisture hay and compared to normal sun-cured hay.

## Body Reactions to Temperature

University veterinarians want to find out how animals regulate their temperatures to withstand the extreme changes in temperature. Because hibernating woodchucks are able to keep certain parts of their body warm while allowing the temperature of other parts to be lowered, they are proving to be useful research animals.

Cattle in the Maryland area undergo extreme changes in temperature at times, but their bodies react quite differently. If the method for the woodchuck's body temperature control can be discovered, the information may be of value to Maryland livestock producers.

## Timing Reproductive Activity

In swine reproduction research, University of Maryland animal scientists have found that hormonal changes that stimulate ovarian activity related to high conception rates are more extensive during hours of darkness. These findings indicate that management practices that provide mating opportunities for the swine during the evening and early morning hours will contribute to higher conception rates for swine.

## Testing Hormones in Cattle

Prostaglandins, hormone-like chemicals used in controlling reproduction in cattle, may become more widely used by dairymen in the future. Although these chemicals are naturally present in a cow's body, scientists want to know what effect further injections will have on milk quality and quantity. Preliminary data indicate that relatively little injected prostaglandin finds its way into milk. Present studies are directed at finding the exact amounts of natural prostaglandin that are in milk before, during and after estrous, and at various stages of pregnancy and lactation. These findings will serve as a guide for setting tolerance levels for prostaglandin in milk.

## Protein Nutritional Values

Protein is an essential, but expensive, part of the diet of healthy, high-producing dairy cattle. As Maryland dairy scientists are learning, however, the nutritional value of protein will vary with the source of the protein. In an extensive experiment now underway, these scientists are gathering information from feeding trials that compare diets using only natural sources of protein with diets that include both natural proteins and urea. Data from this experiment will enable researchers to adjust protein levels in commercial cattle diets so as to improve production levels with less total protein.

## Forage Uses for Dairy Cattle

Corn silage is a popular and economical forage for dairy cattle. Yet some dairymen report that when corn silage is fed over long periods of time, cattle have less resistance to disease. Researchers at the University of Maryland are observing cows fed corn silage for their resistance to infection and other forms of stress. The study covers a period of three lactations to determine if there are cumulative effects over an extended period of time. Observations from this research will provide the basis for counteracting any deficiencies in an all-corn silage forage ration for lactating cows.

## Reproductive Development in Heifers

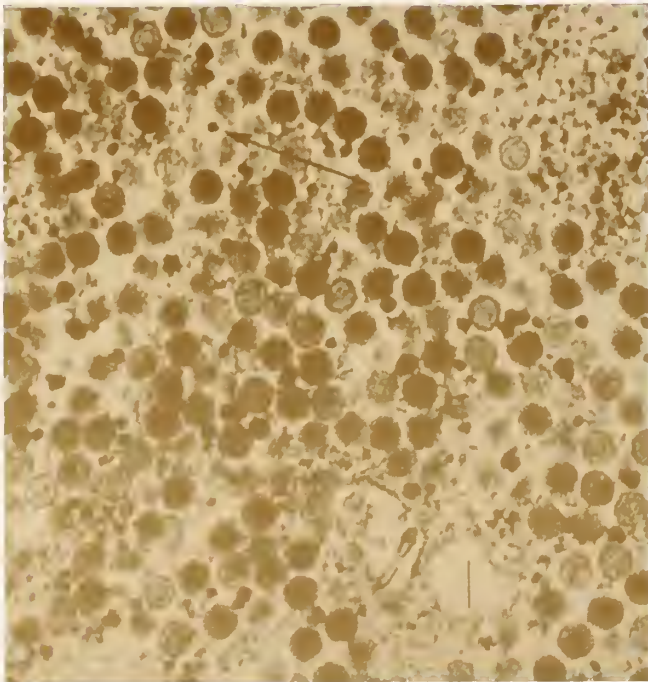
Maryland scientists are trying to determine the factors that influence normal reproductive development in heifers and the age at which each stage of development occurs. The scientists are studying both live fetuses and young heifers. This study will help pinpoint causes of calving abnormalities that are costing Maryland farmers thousands of dollars each year.

## Following Fatty Acids

Changes in the price of feed ingredients usually mean that corresponding changes will take place in the diets of dairy animals. However, University of Maryland scientists are finding that changes in feed rations can affect milk flavor and consumer acceptance of milk. Specifically, the scientists have been studying the effects of changes in ration ingredients on the composition of fatty acids in milk. Two different rations were studied. One was composed of 100 percent hay and the other of 90 percent grain concentrates, plus 10 percent hay. Scientists found that the butterfat from cattle on all hay contained twice as much branched chain fatty acid as the butterfat from cattle on grain concentrates. However, the cattle on grain concentrates produced butterfat with more unsaturated fatty acids, which tend to give milk an off flavor. Findings from this experiment may help dairy-men improve consumer acceptance of milk by changing the balance of hay and grain concentrates in cattle rations.

## Isolating Viruses in Cattle

Cattlemen often wonder how infectious organisms find their way into herds. Veterinarians at the University of Maryland theorize that the cause of sickness may be the activation by stress of dormant viruses present in the animals. In one herd they isolated 20 of the 22 viruses known to cause respiratory infections in cattle. In one calf, a virus was isolated before weaning. Following weaning, the calf became sick. The veterinarians re-isolated the now-active virus found dormant in the calf before weaning. This shows the likelihood of stress on an animal causing a virus-related sickness.



Veterinarians have isolated many of the respiratory viruses that infect cattle. Shown here is a microscopic view of one of them.

## Cooling Soft Shell Clams

Ice, dry ice or mechanical refrigeration, used with forced air, provide satisfactory cooling for freshly harvested soft shell clams. These processes cool the clams enough to protect them from bacteria attacks, according to research by the Maryland Agricultural Experiment Station. If soft shell clams are not cooled following harvest, they will be attacked by bacteria and many commercial buyers will reject them. Station scientists caution, however, that if dry ice is used for long periods, operators should be sure the clams do not freeze or become exposed to high concentrations of carbon dioxide.

## Treating Viral Infections

Scientists at the Maryland Agricultural Experiment Station hope they are on the track of a possible treatment for viral infections in cattle. In isolating an adeno virus from a cow, scientists also discovered and isolated adeno-associated virus particles. When they grew these two materials in tissue culture, the adeno associated virus outgrew and destroyed the adeno virus. Once the adeno virus was destroyed, the adeno-associated virus stopped growing and died. If this tissue culture experiment can be duplicated in a cow's body, scientists say they will have carried out one of the first treatments known for controlling a viral respiratory infection in cattle.

## Finding the Trigger for Cancer

Veterinarians at the University of Maryland are doing some basic cancer research with cats. The scientists know that cats are born with two types of tumor viruses in their bodies. However, they do not know what triggers the growth of these viruses. They are trying to link rodent viruses (with which cats come in frequent contact) with the tumor formations. The cats are being injected with different rodent viruses to see if any of them will trigger the growth of the tumor viruses.

## Improving Commercial Broilers

The development of blisters on the breasts of commercial broilers results in the downgrading of millions of birds each year. In Maryland, this reduces total revenue by hundreds of thousands of dollars for commercial broiler operations. Poultry scientists at the Maryland Agricultural Experiment Station have developed a breeding and selection program for birds with high growth rates and freedom from blisters. Their results so far show that the blistering condition is associated with the weight of the bird at eight weeks, and is more prevalent in males. Blistering is not influenced by the type of comb the bird carries, a previously held theory. The scientists have determined that although highly associated with body weight, blistering is influenced by genetic factors independent of those that affect growth. Therefore, a breeding program by major breeders designed to reduce or eliminate blistering while continuing to improve growth rate should be successful.



Research work with cattle has taken much of the guesswork out of selecting commercial breeding stock for Maryland cattlemen.

### Selecting Breeding Stock

Cattlemen now have two very good ways to select more economical breeding stock, as a result of recent research. One way is to measure the animals and use those dimensions in a formula that estimates the actual weights of wholesale cuts from carcasses. The other way is to feed the breeding stock individually to determine their efficiency in utilizing feed. Some animals need as much as one-fourth to one-third more feed than other cattle to maintain weight and growth. This feed utilization trait is influenced greatly by heredity and is passed along from animals to their offspring.

### Overcoming Confinement Problems

Close confinement of commercial swine herds and hard floor surfaces have resulted in poor performance when a large number of animals have uneven toes and other abnormal skeletal variations. The University of Maryland swine herd is no exception; however, animal scientists there have found that these traits may be overcome through careful selection and breeding among the animals. A University breeding program has sharply reduced the number of animals exhibiting these traits. This program could be readily adapted by commercial operators with equally good results.

### Increasing Forage Consumption

Although it is commonly accepted that young, growing pigs have a limited capability for digesting forages, researchers at the Maryland Agricultural Experiment Station have shown that breeding swine can handle maintenance diets containing 40 to 60 percent ground hay. Station scientists are also incorporating hay into the diets of growing pigs to determine the influence of fiber on digestive tract development, and on the ability of the pigs to handle larger quantities of forage in the diet. Based on the research, feeding forages to mature swine could become a commonplace occurrence if grain supplies should be short.

### Cows Counting Calories

#### Calorie conscious cows?

That may be the trend in the future, after scientists at the University of Maryland release their findings from a recent study of dairy cattle diets. The scientists monitored cattle diets for periods of high calorie and low calorie needs and adjusted the rations to fit the situation. The concentration of energy (caloric density) demand is greater in periods such as late in lactation or when the cow is dry. This allows the dairymen to use feed ingredients more efficiently and lower overall feed costs. It also allows them to make the best use of forage in meeting the caloric density needs of cows.

Dairy scientists are watching the diets of dairy cattle to make sure their calorie needs are met while maximizing forage use.





Solar energy collectors are being used on experimental broiler houses to see if it is economically feasible to install such units on a large scale.

## Utilizing Solar Energy

Solar energy use by Maryland broiler producers in heating brooder houses may become a feasible operation on the basis of Maryland Agricultural Experiment Station research. A solar collection system, designed and installed at the Salisbury Broiler Research facility, is collecting enough energy to supply three-fourths of the heat needed to meet the peak demands of January and February. In addition, station engineers are continuing to improve the efficiency of the entire system as more information is gathered on each component part.

Physiologically, the broilers used in the energy study responded no differently to the solar energy heating than to a normal heating system.

## Utilizing Broiler Litter

Broiler litter, generally used as fertilizer, can also be used as a source of protein in rations for beef and sheep, according to University of Maryland research. The litter must be heated to kill bacteria and improve palatability. Research is in progress to determine the exact nutrient content and to measure the growth of animals on diets supplemented with the litter.

## Shearing Frozen Fish

University of Maryland agricultural engineers are working with shearing devices that could represent an important saving in the cost of processing frozen fish. At present, frozen fish are cut into portion size pieces by band saws or gang circular saws. These saws produce fish "sawdust" which amounts to three to five percent waste of edible fish. The engineering goal is to design a device that produces no sawdust.

## Horse Hoof Hardness

A study to determine the factors influencing hoof hardness in horses has just been completed by the Maryland Agricultural Experiment Station. Hard hooves are important to the utility of both pleasure and work horses, yet little previous research has been done. The Maryland researchers who studied hoof color, moisture content and age of the horse found that moisture content and age were important factors; hoof color was not. There is a rapid rise in hoof hardness when moisture content falls below 19.5 percent. Also, the age of the horse, when related to moisture content, corresponds directly to hoof hardness. The older the horse the harder the hooves.

## Identifying Reproductive Failures

The death of the embryo in the early stages of development is one of the major causes of reproductive failure in cattle. The early embryo must produce a chemical that maintains the corpus luteum (yellow body) in order to maintain pregnancy. Several studies by Maryland dairy scientists are attempting to isolate this chemical in the cow's body in order to determine the specific function it has in the reproductive system. Once this information is known, death rates in the early stages of pregnancy can be reduced and the number of reproductive successes greatly increased.

## Converting Corn Stalks to Energy

Many farms look on corn stalks as a useless by-product, but Maryland Agricultural Experiment Station research shows that they can serve as a source of energy for cattle and other ruminants. Studies by the University of Maryland scientists show that corn stalks can provide half of the forage for yearling heifers. These scientists report that younger dairy animals can use corn stalks in their diets if three or more pounds of concentrate are also supplied.

## Monitoring Poultry Viruses

The poultry virus disease, infectious bronchitis, can be controlled with vaccines; however, this was not always the case, nor is there any assurance that the present vaccines will continue to give protection against new strains.

The disease became particularly troublesome to Delmarva broiler producers in the early 1970's, leading University of Maryland scientists to undertake work that resulted in the isolation and identification of the strain causing the outbreaks. This strain was incorporated into the vaccine that ultimately controlled the outbreaks.

Recently scientists isolated additional new strains of the virus from birds from Arkansas and Maine. They are continuing their studies of the disease in order to be ready with the necessary information to stop any outbreaks that might appear in Maryland flocks.

## Blood Removal in Poultry

A system for maximizing blood removal from poultry has been tested by University of Maryland poultry scientists. Blood removal is a vital step in the processing of broilers; if all the blood is not removed from a broiler a condition known as red wing tips will occur. This condition is characterized by discoloration of the wing tips caused by hemorrhaging of the blood vessels and excess retention of blood. The proper use of electrical stunning equipment is essential for eliminating red wing tips. One system that Maryland scientists found to affect maximum bleed-out is the use of a brine stunner connected in an electrical circuit with alternating current (frequency, 60 Hz.; setting, 50 volts).

## Producing Sterile Milk

Several studies are underway by dairy scientists at the University of Maryland to determine the feasibility of producing a sterile milk that will not require refrigeration. Presently, the scientists are using a milk pasteurizer-sterilizer that produces a milk most consumers cannot distinguish from regular pasteurized milk. Investigators are concerned with bacteriological protection of the milk and the effect the new processing system will have on flavor and nutritional value. So far, the new system has produced milk with little or no off flavor. Milk processed by the pasteurizer-sterilizer system and packaged aseptically can be stored at room temperature for up to eight weeks without any noticeable effects on flavor. Nutritional quality will be tested in future experiments.

## Comparing Worming Methods

A comparison of two worming methods for horses by agricultural researchers at the University of Maryland shows that mixing worming compounds in the horses' feed or administering it to them directly are both effective in keeping parasite loads below harmful levels. The study also revealed that internal parasite infestations in horses are more likely to occur in late spring and early fall than at other periods of the year.

## Closing the Calving Gap

An excessive time span between calvings is costly to dairymen. For this reason, dairy scientists at the Maryland Agricultural Experiment Station are testing each of two hormones to see if a high percentage of treated cows can be successfully bred by 30 days after calving. Although the tests are not yet complete — not enough time has elapsed for pregnancy checks — the limited data available suggest that one of the two treatments can significantly reduce the time between calving and breeding.

## Searching for Disease Sources

Ruminant animals are generally considered to be free of dietary requirements for B vitamins because the microorganisms in the rumen produce them. Within the past few years, however, a type of sickness normally associated with a shortage of thiamine (vitamin B<sub>1</sub>) in non-ruminant animals has been showing up in cattle. In their research on this problem, scientists at the Maryland Agricultural Experiment Station have found no relationship between low thiamine intake and the disease. Feeding tests that compared rations containing high and low levels of thiamine were used to confirm the findings. As a result, the scientists are continuing their studies of thiamine effects and are searching for a new source of the disease.

## Utilizing Dairy Wastes

The mechanized composting system designed for the University of Maryland's College Park dairy herd is providing a source of composted dairy manure for research on possible alternative uses of this material. Preliminary tests indicate that the compost can be used as bedding material for dairy cows, as a soil conditioner, or as a substitute for peat moss or pine bark. The dairy manure compost provides low levels of plant nutrients as well.

## Antibiotic Reactions to Temperature

Agricultural scientists at the Maryland Agricultural Experiment Station think that water snakes may help predict the performance of antibiotics in livestock. Specifically, they are seeking a better understanding of the effects of body temperature on the persistence of antibiotic injections.

Presently, antibiotic studies are generally carried out on animals with normal temperatures. In comparison, the body temperature of water snakes can be controlled at various levels, because these reptiles assume the temperature of their environment.

Veterinarians can take the water snakes, hold them at a constant temperature, inject them with antibiotics, and observe what happens to the antibiotics as they break up in the snake's body. Information from this experiment will be helpful in predicting the reaction of livestock to antibiotic treatments. The results may also have implications for human medicine.



# **PLANT AND SOIL SCIENCES**



### New Wheat Variety Released

The Maryland and Virginia Agricultural Experiment Stations released Potomac, a new wheat variety for Mid-Atlantic wheat growers, in 1975. Potomac is a high-yielding variety with excellent test weight and good disease resistance. The variety yields an average of 56 bushels per acre, 10 bushels per acre more than Arthur, which is currently the most popular variety grown in Maryland.

### Studying Food Concentrates

Food scientists at the University of Maryland have just completed a two-year study of nutritional quality and shelf-life of plant and single cell protein concentrates in meat products. Using prepared frozen foods such as Salisbury steak made from beef and textured vegetable protein, scientists found that nutritive value and acceptability remained good for up to one year if the product was held at zero F or lower. When single cell protein was added to the product, it became rancid after six months of storage at the same temperatures. Researchers believe that some of the deterioration may be due to the fats rather than the protein; they plan further tests to see if single cell protein can be added in larger proportions and more of the fat removed.

### The Changing Picture of Nematodes

Nematocides that will control a number of parasitic nematodes on tobacco are being tested by Maryland Agricultural Experiment Station botanists. The nematocides will be effective against certain insects such as the aphid, flea beetle and budworm, and yet be easy to apply to the soil. In the past, a waiting period of two to three weeks was needed before most nematocides were applied, and then they had to be applied with special equipment. The chemicals now being tested can be applied in liquid, granular or both liquid and granular forms, usually using existing farm equipment such as a sprayer or sprinkler. Also, some of these newer chemicals can be applied to the surface without a waiting period. The newer chemicals provide both nematode and insect protection.

### Quality of No-Till Corn

On a percentage basis, Maryland is the leading state in acreage of no-tillage corn. Since most of the corn grown on the Eastern Shore of Maryland is used in formulating broiler rations, poultry scientists wanted to know if the change from conventional tillage practices had affected the nutritional quality of corn. A three-year study has shown that there is no apparent difference in the nutritional quality of the same type of corn when grown by the no-tillage method or by conventional tillage.



Much of the corn planted in Maryland is now planted no-till. The nutritional quality of this no-tillage corn equals that grown under conventional practices.



Growing grapes for wine production has become a new enterprise for some Maryland farms. Varieties are being tested for adaptation to Maryland conditions, and control measures are being developed for disease and insects.

### Managing Grape Plantings

During the past few years there has been an increasing interest in growing grapes, particularly wine varieties, in Maryland. There are presently three wineries operating in the state, two in the Baltimore area and one near Westminster. There are also two new wineries under construction near Frederick.

Scientists of the Maryland Agricultural Experiment Station are keeping pace with this new industry by developing effective controls for three major diseases: black rot, powdery mildew and downy mildew. They have also developed a management program that effectively controls two insects that attack grapes: Japanese beetle and grape phylloxera.

### Improving Maryland Cash Crops

Research has added strength to Maryland's viable grain and soybean industry. Much effort has been directed toward the development of soybeans and small grains adaptable to Maryland's unique soil and climatic conditions. During the past 10 years the Maryland Agricultural Experiment Station has released six new soybean varieties: York, Cutler, Wye, Williams, Essex and Shore. These varieties are grown widely in Maryland and occupy a major portion of the soybean acreage. Along with the development of these varieties has gone work in weed control and other cultural practices. The combined effort of the University research has been to push Maryland's soybean yield average up 34.8 percent in the last 10 years. National soybean yields have risen only 10.7 percent during that period. The value of Maryland soybeans has climbed from \$13 million in 1965 to \$41.8 million in 1975.

### Aflatoxin Control in Food Products

Studies are underway to prevent the development of aflatoxins, which are carcinogenic compounds produced by the mold fungi found in peanut and soybean foods. Botanists are investigating the differences in the amounts and types of fatty acids present in soybeans and peanuts. They hope that eventually they will be able to control the aflatoxin production by changing the genetic makeup of the original host plants.

### Aquatic Grazing Effects

The effects of aquatic grazing animals (rotifers) on the production of plant material in the Chesapeake Bay were examined by botanists at the Maryland Agricultural Experiment Station. They studied three different growth phases of the plants to see which phase was most affected by the grazing animal. It was learned that equal grazing pressure had the least effect on the most rapidly growing plants, and the most effect on the slowest growing plants in terms of removing newly incorporated carbon.

### Nitrogen Fixation Studies

Experiments are being conducted by University of Maryland botanists to extend the process of nitrogen fixation to plants which do not presently fix nitrogen. In nature, the bulk of nitrogen fixation is done by bacteria and blue-green algae, which exist independently in the soil or in association with some plants, particularly legumes. When crop plants do not have nitrogen fixation capabilities, costly fertilizer nitrogen must be applied to the soil. The process botanists are developing would eliminate this need. Present experiments incorporate cells of nitrogen fixing blue-green algae into cultured cells of tobacco and corn. Ultimately, botanists hope to use this process with other plants as well.

### Controlling Stem Blight

Field research by botanists at the Maryland Agricultural Experiment Station has demonstrated that several fungicides are effective in controlling gummy stem blight in pickles. A number of the new disease-resistant pickle varieties grown by farmers in Maryland are resistant to many common diseases, but are highly susceptible to gummy stem blight. Botanists advise farmers to select one of the fungicidal chemicals, benomyl, captafol or chlorothalonil, to control the disease in late pickling plants.

### Preventing Food Spoilage

As soon as a crop is harvested, it begins to spoil. Now, scientists at the Maryland Agricultural Experiment station have found a way to extend shelf-life of harvested foods by stabilizing the microbial action that causes spoilage. Spoilage is normally reduced by either heating, cooling or drying, which costs Maryland's commercial food processors hundreds of thousands of dollars a year. The new process, devised by station scientists, maintains a fresh-like quality for

months by simply exposing the food to a series of gases that inactivate the specific enzymes causing spoilage. Thus far, fresh apples, potatoes, peaches, and mushrooms, and beef cubes and ground patties have been successfully treated. A group of University of Maryland scientists is presently setting up a large scale plant line model of the process to demonstrate its feasibility and energy-saving features.

### Controlling Nutsedge

Nutsedge is a weed that causes economic losses to lima bean crops, and until tests by the Maryland Agricultural Experiment Station were completed, no known herbicides would control the weed. After three years of study, researchers in Maryland have found that bentazon (Basagram®) is a safe and effective herbicide to use against nutsedge. Such herbicide controls will become more important as narrow row plantings of lima beans increase, because narrow row plantings will be cultivated less frequently.

### Potting Mixtures Substitute

Compost made from raw sewage sludge and wood chips makes an ideal substitute for peat moss or ground pine bark for growing ornamental plants. University of Maryland horticulturists, testing potting mixtures containing 75 percent sludge compost and 25 percent subsoil, discovered that marigolds grown in that mixture were just as good as plants grown in normal potting mixtures. The scientists attribute this response to the plant nutrients found in the compost and the moisture-holding capacity of the blend.

### Keeping Plants Warm

Nurserymen have to worry about keeping their plants warm during the long winter months. Present methods of protecting plants are poor, but researchers at the University of Maryland have devised a better method — a micro-foam thermal blanket. In the winter of 1975-76, when this system was used, soil temperatures seldom dropped below freezing even during the coldest part of the winter. Container plants sheltered in unheated plastic covers, the most prevalent practice used today, showed soil temperatures closely parallel to outside temperatures which caused extensive damage to the plants. Plants under the micro-foam blanket showed very little damage.

### Plant Adaptation in Acid Soils

Botanists at the University of Maryland think they may be able to explain how plants survive or adapt to acid soils. This will be a great aid to Maryland farmers; many of our high yielding varieties of crop plants are bred in the West or Midwest where soils are not generally acidic. Botanists have found that plants that do survive in acid soils absorb and utilize nitrate and potassium during the process of neutralizing the soil around them. These experiments show that the entire process of neutralization is dependent upon the presence of potassium.

### Designing Flood Control Structures

University of Maryland agricultural engineers, working in cooperation with USDA, are developing flood control structure standards that can be used on a national, regional or specific-location basis. The first phase of this project, a review of the literature to determine what methods have been used in the past, is now being completed. Once the literature review is finished, the engineers will evaluate the flood control methods to see which gives the best estimates of peak flow rates and the return frequency of that flow under flood conditions.

### Chemical Controls in Ornamentals

After five years of testing alachlor on yellow nutsedge in all species of ornamental plants, University of Maryland horticulturists found that nine species showed no growth retardation and nearly all yellow nutsedge was eradicated. The other two species showed some growth retardation when the chemical was applied, pre-emergence, at six to eight pounds per acre.

### Reducing Nutrient Loss

A new program to reduce the loss of nutrients from high moisture hay during storage has been designed by scientists at the Maryland Agricultural Experiment Station. By adding 1.5 percent propionic acid to reconstituted alfalfa hay with as much as 40 percent moisture content, the scientists were able to prevent the heating that is associated with molding and dry matter losses. By comparison, 40 percent moisture hay that was not treated with the propionic acid had dry matter losses of 30 percent.



High moisture hay can now be harvested by Maryland farmers without fear of loss due to decay, thanks to the use of new chemical preservatives which have been found to be safe and effective by Maryland research workers.

## Curing Maryland Tobacco

Two new methods of curing leaf tobacco are being studied by engineering and agronomy researchers to help Maryland farmers reduce the labor involved in raising tobacco. Leaves are stripped from the tobacco stalks in the fields and placed in racks to undergo either heated or natural air curing. Heat curing requires more energy and capital expenditure but cures the tobacco faster. The air curing process needs no additional heat and can be accomplished by using existing barns with slight modifications.

## Using Forage Preservatives

High moisture alfalfa forages can be preserved by the use of organic acids; however, this process is not profitable if moisture content is as high as 50 percent. This finding is the result of tests by Maryland agricultural engineers who used weather data and harvesting information to compute the benefits of using high moisture preservatives.

## Applying Nitrogen to Tobacco

In an experiment involving four nitrogen rates and six tobacco varieties, station scientists found that, in general, the yield and dollar return per acre increased as nitrogen rates increased from 80 to 120 pounds per acre. But when 120 to 140 pounds of nitrogen were applied, yield and dollar value decreased slightly. Also, increased rates of nitrogen resulted in an increase in content of total alkaloids and nitrogen and a decrease in burning ability. The results of the nitrogen fertilization study by the Maryland Agricultural Experiment Station suggest that farmers should be very cautious in applying high rates of nitrogen to their tobacco crop.

## Increasing Soybean Yields

Research on no-tillage soybeans planted in small grain stubble shows that yields can be increased up to 50 percent by using a combination of the proper varieties, row widths, seeding rates and weed control practices. These outstanding yields, plus the soil and energy conserving advantages of no-tillage, led to the wide adoption of the practice by Maryland farmers. A 1976 survey by the Maryland Crop Reporting Service shows that about 70 percent of the double cropped soybeans grown in Maryland are no-tillage. A recent national survey shows Maryland to be number one among the states in the acceptance of no-tillage crop production.

## Soybean Seed Treatment

A cooperative experiment with 15 other states on the seed treatment of soybeans has helped Maryland Experiment Station botanists identify two chemicals that may increase germination rates from soybean plantings. The new chemicals control certain parasitic fungi on soybean seed. The best treatments allowed nearly 100 percent of the expected germination.

## Greenhouse Growing Mediums

Pine bark can be used as a growing medium in greenhouse operations, according to the results of experiments by the Maryland Agricultural Experiment Station. Large volumes of bark have become available in recent years because of the centralization of most lumbering operations. Pine bark costs only one-third to one-half as much as peat moss, the standard growing medium used in most greenhouse operations. As a result of their research, station scientists expect that many greenhouse operators will begin using equal parts of vermiculite and pine bark as a joining mixture. Preliminary research also indicates that 100 percent pine bark, fortified with lime and fertilizer, may also be used as a peat moss substitute.



Because of the centralization of the debarking of pine trees, large amounts of pine bark have been made available for alternative uses. Horticultural researchers at the University of Maryland have come up with several uses for the product.

## Ozone Effects on Plants

Maryland Agricultural Experiment Station botanists are studying the effects of ozone, an air pollutant, on the leaf chemistry of two soybean varieties that are grown in Maryland: York and Wye. York is more resistant to the ozone pollution than Wye, but the reason for this resistance is not known. Botanists are studying some of the physical and chemical features of the leaf to see if they can identify the causes of the increased resistance.

## Mapping Tidal Marsh Soils

A timely study of Maryland tidal marsh soils will help guide the state and private owners in the management and use of these increasingly important 200,000 acres of land. University of Maryland soil scientists identified three basic soil types in the tidal marshes: Submerged Upland, Estuarine and Coastal. The Submerged Upland type makes up 53.7 percent of the marsh soil and has many properties of soils normally associated with above-water soils, such as the clayey subsoil in the Elkton and Othello soils. The Estuarine type accounts for 37.7 percent of the tidal marsh soils and the Coastal type accounts for the remaining 8.6 percent.

## Disease Control in Tobacco

Following work that showed some tobacco varieties are susceptible to severe etch virus if transmitted by aphids, breeding work is being conducted with Maryland Type 32 tobacco to produce seeds that are resistant to the disease. Some selections that have good viable seed have been made from the breeding crosses and have been indexed for resistance to the severe etch virus.

## Using Parasites in Pest Management

Tiny wasps that parasitize Mexican bean beetles are saving Maryland's soybean growers hundreds of thousands of dollars a year. The success of this novel approach to pest management reflects the research leadership of the Maryland Agricultural Experiment Station.

Station entomologists initiated this research in 1972, utilizing a parasitic wasp from India that attacks and kills the immature stage of bean beetles. In 1974 and 1975, the widespread field release of wasps early in the season greatly reduced the bean beetle population. Pre-harvest surveys on Maryland's Eastern Shore showed that more than 90 percent of all bean beetle larvae were destroyed. In most soybean fields this was enough to eliminate the need for applying chemical controls. An additional benefit was a lower than normal population of bean beetles the following springs. Station entomologists not only expect this type of biological control to continue to be effective against bean beetles, but they also believe the concept can be applicable to insect control in other crops.

## Virus Infection of Hollies

Botanists at the University of Maryland have isolated what they think is the first naturally occurring virus on a holly plant. The leaves on a Maryland-grown Japanese holly had chlorotic (yellow) ringspots; botanists have isolated the virus and shown that it is related to the tobacco ringspot virus. The virus is transmitted in the soil by nematodes.



# **ECONOMICS, ENVIRONMENT AND HUMAN ECOLOGY**

## Economic Impact of Pleasure Horse Industry

There are between 50,000 and 60,000 horses and 13,000 owners who contribute to the pleasure horse industry in Maryland, according to economists of the state's Agricultural Experiment Station who recently completed a study of the industry. In terms of Maryland's economy, these pleasure horse owners or breeders, and the veterinarians, farriers and others providing goods or services to them, are spending at least \$50 million a year on their horses and other industry-related activities.

The study, which will soon be available as a published report, will provide detailed data on the industry that will be useful to legislators, public administrators and others who must make decisions on research priorities and zoning, recreation and land use policies affecting all Maryland citizens.

## Plastic Packaging as Fertilizer

Plastic bags may have a potential for adding fertility to the soil, according to agricultural scientists at the University of Maryland. Presently, plastic packages present a serious litter and disposal problem because they do not degrade in the soil. Researchers in the Department of Horticulture tested a large number of plastic packaging films and found that certain micro-organisms are capable of degrading a number of plastics, including certain types of nylon prepared by chemists at the University. Not only did the materials degrade in the soil, they improved crop production by adding nitrogen and improving the physical condition of the soil.

## Bacteria's Survival in Clams

Researchers at the University of Maryland are studying the effects of changes in water salinity and temperature on bacteria in soft shell clams. They are changing salinity and temperatures to see if they can predict the reactions of bacteria to the changing levels; they believe that the interaction of water salinity and temperature will support bacteria growth primarily at specific levels. If these levels can be pinpointed, the information will enable clam harvesters to avoid situations where bacterial growth exist.

## Redesigning Respirators

Agricultural engineers at the University of Maryland are redesigning the respirators that farmers and other agricultural workers wear as protection against the various pesticides and other toxic materials that are a part of modern day farming practices.

The goal of the engineering research is to make respirators more comfortable and more compatible with human respiratory needs. Respirators that are better designed will get more use, resulting in greater safety, the engineers believe. They are using men and women subjects to check heart rate, respiratory air flow, and exhaled gas components under varying stress conditions.



The pleasure horse industry in the state affects a large number of Maryland residents and generates over \$50 million in economic activity.



Good management practices return as much as 9 to 11 percent on investment in pine plantations.

## Pine Plantation Possibilities

By following good management practices, Maryland loblolly pine growers can have an annual return on their investment of as much as 9 to 11 percent, according to preliminary figures of the Maryland Agricultural Experiment Station. This, coupled with the fact that public forests and private woodlots are having difficulty meeting the industrial demand for wood products, points to an expanding market for Maryland forest owners.

## Community Planning and Development

An advisory committee made up of representatives from public groups in Dorchester county is working with researchers from the Maryland Agricultural Experiment Station to set up economic development strategies and policies for the county, and to design ways to implement the plans. To speed up the county's assessment of the impact of various changes in the community, a complex computerized model is being developed. This model will be tested in Dorchester county, but will be available to other nonmetropolitan counties in Maryland for planning economic development policies.

## Fighting Regional Unemployment

A recent study of the southern Delmarva region by the Maryland Agricultural Experiment Station has shown that the meat packing and grain mill products industries contribute greatly to that region's economy. The findings also revealed that forest-based industry contributes little to the overall economy. The meat packing and grain mill products industries contribute 6.5 percent of the gross regional product. But more

importantly, every dollar of output generates five to six dollars of income for the region, and every new job within these industries stimulates five to six new jobs elsewhere in the local economy.

## Horse Farm Record System

Agricultural economists of the University of Maryland are developing a practical management tool for horse owners in the state through the use of a computerized data collection system. When the system is completed it will provide owners with information on labor, equipment use, breeding and health programs, alternative feeding systems and related management information.

## Organization of World Agricultural Resources

A community in a North Indian village was studied by agricultural economists of the Maryland Agricultural Experiment Station to analyze social and economic change in an agricultural community over a period of 18 years. The project is now complete and has resulted in a publication that shows changes in land tenure patterns, the progress of the agricultural Extension Service and the adoption of new agricultural practices by the villagers. These findings will help other economists establish and improve agricultural programs in developing countries.

## Economics of World Food Situation

University of Maryland research started in 1975 on the economic limitations of feeding the world's population and has touched areas affecting agricultural practices throughout the world. One study shows the effect of the economic decisions of farmers in developing nations on the type and level of their trade with the United States. Another study points up the need for grain reserves and proposes ways of establishing them. A third study gives some of the agricultural policy issues facing developing countries and provides a way to evaluate them. A final project deals with the resources needed to expand food production in India and Bangladesh, using various levels of technology.

All of these items will have an effect on the future of U.S. agricultural policy on a national, state and local level.

## Economics of Sod Production

Economists of the Maryland Agricultural Experiment Station are completing a study that will help the state's sod producers maintain their leadership in the northeast marketplace. A survey of commercial sod producers has brought together information on production costs, labor requirements, acreages of varieties being grown, acreage harvested, marketing practices and prices received. From these facts, the economists are developing a general description of the sod industry that includes size, organization, operation, investment and economic impact information. This will aid sod producers in making future management decisions.

## Marketing Fresh Fruit and Vegetables

If you have constructive suggestions regarding fresh tomato marketing, you may have a chance to make them known. Maryland agricultural scientists are studying a sample of consumers to determine purchase behavior and use of fresh tomatoes. This study is similar to one just completed on consumers' views of fresh apple marketing practices. The information gathered in the two projects will be used to help dealers improve the marketing systems for these commodities.

## Spray Irrigation of Sewage Sludge

The Botany Department of the University of Maryland is studying the effects of spraying sewage sludge on forests to determine the right amount of spray needed to maintain a balance between harmful and beneficial results. The system botanists devise will aid growing communities in handling the increased problem of sewage disposal while maintaining high-quality recreational areas. The raw sewage used in this experiment is subjected to the usual primary and secondary treatments before it is sprayed on the forest area. By the time the liquid reaches the water table, the soil and forest plants have purified it, primarily by removing nitrogen and phosphorus. These two chemicals enrich the forest plants.

## Fighting Broiler Condemnations

An economic study that led to recommendations for better management has enabled Delmarva broiler producers to greatly increase their incomes and improve their competitive position in the East.

In 1967, the Delmarva broiler industry was at a one cent per pound disadvantage with their competitors because of the loss of broiler meat through condemnations. A thorough study by the Maryland Agricultural Experiment Station pinpointed problems and offered recommendations for improvements in both management and technological practices.

By putting these recommendations to work, the Delmarva broiler industry had, by 1975, turned the one cent disadvantage into a half cent advantage over their eastern state competitors. During the nine-year period, Maryland broiler growers increased their income by nearly \$6 million; the entire Delmarva industry increase was \$14 million.

## Impact of Environmental Controls

New federal environmental control practices for Maryland's broiler industry will increase production costs. But just how much, and who will be affected by the increases was what the industry and the Maryland Agricultural Experiment Station wanted to know. Research on these questions, undertaken by station economists, shows that the small broiler producer will be most affected. Plants processing 15,000 birds per day will have an added cost of 0.24 cents per pound; 75,000-bird-per-day plants will have increased costs of 0.07 cents per pound; and plants processing 150,000 birds per day will pay 0.04 cents per pound in additional costs.

## Developing State Fisheries

Further clarification of many aspects of fishery regulations is needed if there is to be effective planning to meet Maryland's future recreational and commercial demands, according to agricultural economists of the University of Maryland. Although their study has only begun, the economists have identified vague and confusing regulations as a roadblock to the progressive development of fishing in the state.

## Utilizing Processing Wastes

Regulations of the Environmental Protection Agency that severely limit the discharge of dairy processing plants into streams has caused University of Maryland research to look for ways to use these wastes. As a result of their efforts, scientists have developed ways of using whey in making everything from cookies to sausage. If their whey is used in this manner, dairy plant operations will be more profitable, the pollution problems will be eliminated, and consumers will add some new, nutritious food products to their diets.

## Planting Buffer Strips

In a study to determine the feasibility of using grass as a buffer between farmland and streams, University of Maryland agronomists found that a 13-foot wide strip of Kentucky 31 tall fescue was effective in reducing surface run off from a field treated with dairy manure and sewage sludge.

This experiment was carried out on a Chester silt loam soil with a 10 percent slope toward the stream. Other soil types and slopes would require grass buffer strips tailored to the different conditions.



Several experiments are underway by the Maryland Agricultural Experiment Station to determine ways of controlling pollution in agriculture. Here, samples are being taken from an experimental site where the effects of buffer strips in controlling pollution runoff are being studied.



Each year more and more Maryland farmland is converted to other uses. Maryland scientists have been following the progress of this transition and have made recommendations to state and local governments concerning land preservation.

### Land Values of Farm Real Estate

Maryland farm real estate values increased at an average yearly compound rate of 8.7 percent between 1950 and 1974, measured in current dollars, according to results of a newly completed study by agricultural economists of the University of Maryland. During that same time period, farmland in Maryland declined by about 65,000 acres annually. This decline in farmland and increased value partially reflect the competition from nonfarm land uses. The survey provides information to state leaders that will be useful in setting policy and making decisions on the long term preservation of agricultural land.

### Optimum Farm Management

Twenty percent of the farmers in Worcester county have been surveyed by University of Maryland agricultural economists and a similar survey is nearing completion in Calvert county. The information they are gathering will be used to help low income, limited resource farmers. Survey information will be combined with information from the census and studies on costs and returns for farmers in these areas. Once a realistic appraisal of the resources available to these farmers is complete, the economists will design a linear programming model to aid the farmers in determining the best use of their limited resources.

### Composted Sewage Sludge

Screened sewage sludge compost appears to be an ideal mulching material for plants growing on poor soils. When University of Maryland researchers used the compost around one year old seedlings of white pine and Norway spruce, the plants grew as well as other seedlings fertilized with a commercial slow release fertilizer. In addition to fertilizing, the compost mulch helped to conserve moisture.

### Assessing Solar Energy Needs

Under the leadership of agricultural engineers and agricultural economists, the Maryland Agricultural Experiment Station has just completed a project in conjunction with federal agencies to assess the future solar energy application possibilities for agriculture. The major results of the project were (1) the identification of present agricultural practices that may potentially use solar energy; (2) the establishment of an experimental research program to test the technical and economic feasibility of using solar energy in agriculture; and (3) the development of strategies to achieve adoption of solar energy systems in agriculture.

### Meeting Agency Requirements

Firms engaged in the oyster shucking business are faced with new Health Department and Environmental Protection Agency regulations that will require the use of new machinery. Health Department regulations require that the oysters be washed before shucking. This process will increase the amount of effluent from oyster processing plants, while EPA standards are being tightened to limit the amount of discharge from the plants. University of Maryland agricultural engineers have developed three oyster washing machines that meet health regulations, and will test each of the washers to see how well they meet EPA pollution standards.

### Sprinkling Sewage Effluent

The application of sewage effluent from a housing development to forest soils with high ground water showed these soils to be removing practically all of the nitrogen and phosphorus from the effluent before it reached the small streams draining the area. The sewage sludge was applied by sprinklers in a carefully monitored research study by University of Maryland agronomists. These excellent results indicate that sprinkler irrigation, even on forest soils with high ground waters, will eliminate the problem of nitrogen and phosphorus additions to local waterways.

## Establishing Bacteria Standards

A bill covering bacterial standards on fresh meat was introduced in the Maryland legislature during 1975. Subsequent hearings on the bill have pointed out the need for bacteriological data in order to establish realistic standards for the meat industry within the state. Agricultural researchers at the Maryland Agricultural Experiment Station have finished charting bacteria counts in fresh ground beef, and legislators are now analyzing these data for use as a base for further action on the original bill. Copies of the report are available from the Dairy Science Department at the University of Maryland, College Park.

## Reducing Fuel Consumption

Reducing fuel consumption by 40 percent represents a large saving in anyone's budget, but if fully implemented by the Maryland broiler industry, it could mean saving millions of dollars in the next five years alone. Scientists at the University of Maryland maintain that these savings can be realized by turning the thermostat down in brooding houses. They conducted experiments with birds at four temperature levels and found that 26.7C suits the birds just as well as the normally used temperatures of 35.0C, 32.2C and 29.4C.

## Maintaining Production Outlook

Although the annual production of milk per cow in Maryland reached a record 11,100 pounds in 1975, the costs of feed, labor and interest on capital have more than offset the monetary gains from increased production. These statistics, compiled by Maryland Agricultural Experiment Station economists, will keep dairymen better informed about their economic problems as well as help determine new ways of cutting production costs. The study will also help government officials to make adjustments in the pricing of milk on the local markets.

## Sickle Cell Anemia

Researchers at the Maryland Agricultural Experiment Station are conducting studies with sickle cell anemia patients to determine if there is a correlation between trace minerals and the occurrence of sickle cell anemia. One study of zinc levels found that sickle cell patients were not zinc deficient, as was previously thought. Copper blood levels in sickle cell patients, however, were significantly higher than in normal control subjects. Further studies are being conducted to see if there is a direct relationship between copper levels and sickle cell anemia.

## Reducing Water Use

Poultry researchers have discovered a way to reduce the amount of water needed to clean dressed poultry in the processing plant. This new system of washing, which takes into account the size of the spray nozzle, the angle of the spray, the water pressure and the distance of the nozzle from the carcass, may use only half as much water as the system now being used in most broiler processing operations.

## Monitoring Heavy Metals

The use of sewage sludge on agricultural lands requires a knowledge of the fate of sludge-borne heavy metals which may be toxic to plants and animals. For example, Maryland Agricultural Experiment Station research on heavy metals shows that cadmium, a danger to the food chain, remains more available to plants over time than copper, nickel and zinc. This finding suggests that sewage sludge with a high cadmium content may face serious use limitations on farms.



Liquid sludge often carries with it heavy metals. Scientists are monitoring the soil where sewage sludge has been applied to see if this will be a limiting factor for its use on agricultural land.



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# ADMINISTRATION

## FINANCIAL STATEMENT 1975-1976

### SOURCES OF INCOME

General	
Hatch (Requires matching funds above \$90,000)	873,226
Hatch Regional Funds	306,745
McIntire-Stennis (Requires matching funds)	93,898
Rural Development Funds	17,723
	<hr/>
	1,291,592
State Appropriation	3,135,949
	<hr/>
Total	4,427,541

### EXPENDITURES BY MAJOR RESEARCH AREAS\*

Animal, Avian Agriculture	1,749,764
Plant and Soil Sciences	1,747,108
Environmental and Production Systems	304,172
Social Sciences and Human Ecology	496,770
Administration	129,727
	<hr/>
Total	4,427,541

\*Approximate figures, final FY 76 financial data incomplete.

### Percent of Expenditures by Major Research Areas

Animal and Avian Agriculture

40

Plant and Soil Sciences

39

Social Sciences and Human Ecology

11

Environmental and Production Systems

7

Administration

3

# MARYLAND'S RESEARCH FARMS



1. Maryland Agricultural Experiment Station. Headquarters 1326 Symons Hall. Established 1888. Research work in all phases of agriculture and related fields.
2. Plant Research Farm (Montgomery County). Research on turfgrass, insects, truck crops and small fruit. 320 acres.
3. Agronomy-Dairy Forage Farm (Howard County). Studies of dairy nutrition and management, forage production, swine nutrition and management and pollution abatement practices. 926 acres.
4. Horse Research Center (Howard County). Experiments studying physiology, nutrition and management of horses. 160 acres.
5. Beef Research Center (Carroll County). Research concerning livestock production and management. 720 acres.
6. Tobacco Research Farm (Prince George's County). Research relating to tobacco breeding, production, harvesting and curing. 206 acres.
7. Wye Institute (Queen Anne's County). Work on plant breeding, weed and disease control, and production systems for corn, soybeans, vegetables and ornamentals. 125 acres.
8. Salisbury Research Substation (Wicomico County). Experimental studies dealing with poultry and breeding, insect, pest and disease control, production systems and management and processing of vegetable crops. 89 acres.
9. Poplar Hill Research Farm (Wicomico County). Studies of disease control, breeding, pest control and production systems for corn, soybeans and vegetable crops. 100 acres.
10. Fruit Research Center (Washington County). Research on fruit production, disease control and fruit insects. 28 acres (leased).

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1944

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